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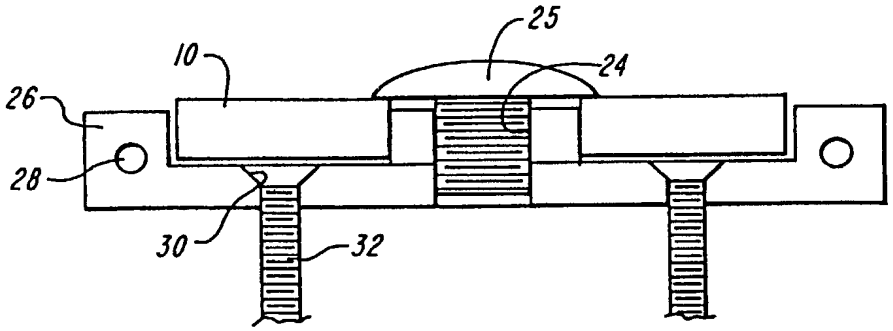
(54) Title: MODULAR ANTERIOR CERVICAL PLATE

(57) Abstract

An anterior cervical plate system consists of a base plate (20), and a connecting plate (10). The base plate (20) can be inserted into any numbers of cervical vertebral bodies in any one construct. It contains holes (30) for two unicortical bone screws (32), and a third hole (24) to accommodate a rather large diameter, but short screw (25) that secures a connecting plate (10), raised middle portion (22) to strengthen screw purchase and fit of the connecting plate (10). The connecting plate (10) has a central trough opening (12) to accommodate this screw (25).



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MODULAR ANTERIOR CERVICAL PLATE

Background of the Invention

This invention relates to a modular anterior cervical plate designed to provide internal stabilization (temporary strengthening) to the spine in the cervical region (neck) during surgical repairs through an anterior approach to the neck.

This device would make it more likely that surgical fusion will be followed by bony union, and would lessen the need for external braces following surgery. This is not the first anterior cervical plate ever designed, but it has several novel features that will facilitate decompressive aspects of cervical spine surgery, and will facilitate compression and distraction during cervical fusion and will allow dynamic settling if necessary in the first several weeks after surgery.

Devices presently on the market are basically thin (<2.5mm thick) molded metal plates that bridge gaps in the front of the cervical spine caused by surgery. (Examples are the Orion plate by Sofomor-Danke, the Codman plate by Johnson and Johnson, the Morsher plate by Synthes Inc., the Acromed plate, and others.) They stabilize the spine when screws are inserted through holes in the plate into bone above and below the surgical gap in the spine. All plates on the market today are basically a single unit design as such.

Summary of The Invention

This design is different in that it involves the use of modular parts, the base plate and a connecting plate. The base plate design has two advantages. First, because of its small size, it does not obscure surface landmarks on the spine. When surface landmarks are obscured, chances for errant screw insertion and surgical complications increase. Secondly, the base plate can be used with distracting instruments to facilitate distraction during discectomy or other decompressions, which is not a feature of any other anterior plate design.

The base plate and connecting plate combination allow for insertion of fusion bone with distraction or compression, finely manipulated by the surgeon. No other plate design allows for this. With all other plates, one must rely on the tightness of fit obtained with the fusion bone (the degree to which the bone achieves a proper fit) to maximize conditions for fusion. The tighter the fit, the more likely fusion is to take place. Since this plate can maximize compression forces beyond what can be obtained with traditional plate designs, fusion rates should be higher. Finally, the connecting plate to base plate interface can be modified to allow settling of the spine over several weeks time in the saggital and coronal planes to the spine. Particularly, when large surgical gaps are created, this kind of settling caused by gravity is felt to promote fusion. This function is available in only one other plate design on the market (Acromed), but by a different mechanism.

These advantages are derived from the modular design. With the development of a thickened midsection of the base plate, a 6/32 screw has been shown in pullout tests to hold the two plates together very tightly; well beyond the forces required to cause plate failure at the bone-bone screw interface in the vertebral body above and below the gaps. Additionally the connecting plate is further constrained from rotational movement by raised distraction and compression knobs at the lateral margins of the base plate. Therefore, we believe there is no reason to believe that this design will fail under expected mechanical stresses, yet the unique advantages of the modular design will remain.

Brief Description of the Drawings

FIG. 1 is a perspective view of the connecting plate of the invention;

FIG. 2 is a perspective view of the base plate of the invention;

FIG. 3 is a perspective view of the connecting plate and two base plates as they would be assembled;

FIG. 4 is a cross sectional view of the assembled device;

FIG. 5 is a schematic side view of the assembly of the invention attached to the spine; and

FIG. 6 is a schematic plan view of the assembly of the invention attached to the spine, with a distraction tool attached.

Detailed Description of the Invention

The connecting plate 10 of the invention is a generally rectangular plate, preferably made from titanium alloy. As shown in FIG. 1, the connecting plate has screw slots 12 at either end, and two screw holes 14 for bone graft screws in the middle.

In a preferred embodiment, the connecting plate is 2.02mm thick. Its length may vary, at 5mm intervals, from 18mm to 100mm. Its width is preferably about 16mm.

The base plate 20, as shown in FIG. 2 is generally rectangular, with dimensions, preferably, of a width of 9mm, a length of about 20mm, and a maximum height, a raised central section 22, of about 2.54mm.

The base plate raised central section 22 is generally rectangular and insertable in the screw slot 12 of the connecting plate 10 (see FIG. 3). The base plate raised central section 22 has a threaded screw hole 24 for receiving a central screw 25, preferably of titanium alloy, and a 6/32 thread with 3 turns over 2.0mm, for securing the base plate 20 to the connecting plate 10. The screw slot 12 of the connecting plate may have notches 16 to help fix the position of the central screw 25.

At either side of the base plate 20 are raised distraction-compression knobs or portions 26, defining holes 28 oriented parallel to the spine, for the insertion of elements of distraction tools.

Between the raised central portion 22 of the base plate and the distraction-compression sections 26 at either end, are planar reduced thickness sections 28 (about 0.5mm thick). These reduced thickness sections 28 of the base plate include two bone screw holes 30 for passage of unicortical bone screws, to attach the base plate to vertebral bodies. The bone screws 32 preferably have an outside diameter of 3.5mm and a length between 14mm and 18mm.

As shown in FIG. 4, a pair of base plates 20 are secured to vertebral bodies 40 in the spine by bone screws 32 passing through the bone screw holes 30 of the base plate 20. The connecting plate 10 is placed over the base plates 20 (see FIG. 3), and a central screw 25 is threaded into each base plate central section 24 to secure the connecting plate 10 to the base plates 20. The width of the base plate central section 24, and the distance between the base plate central section 24 and the distraction-compression knobs 26 are selected so that the connecting plate 10 fits snugly and angular movement of the connecting plate 10 relative to the base plate 20 is prevented.

As shown in FIG. 6 a distraction tool 50 may be used with the assembly. Pins 52 the distraction tool 50 are insertable into the holes 28 the distraction-compression knobs 26.

Variations on the assembly are possible. For example, the connecting plate 10 may have screw notches 16 in both screw slots 12, or one of the screw slots 12 may be without notches 16, so that some settling rostrally of the assembly is allowed.

A preferred material to construct the invention is titanium.

What is claimed is:

1. A modular anterior cervical plate assembly comprising;
at least two base plates,
each base plate having means for attachment to vertibral bodies, and
a connecting plate,
said connecting plate having means to secure said connecting plate to said base plates.

2. A modular anterior cervical plate assembly comprising:
at least two base plates,
each base plate comprising
a raised control portion, with a threaded screw hole
screw holes for bone screws to attach said base plate to vertibral bodies, and
distraction-compression portions for attachment to distraction-compression tools, and
a connecting plate,
said connecting plate defining slots for accommodating said base plate raised central portions, and
a connecting screw for attaching said connecting plate to said base plate.

3. The modular anterior cervical plate assembly of claim 1 wherein the assembly comprises titanium.

4. The modular anterior cervical plate assembly of claim 2 where in the assembly comprises titanium.

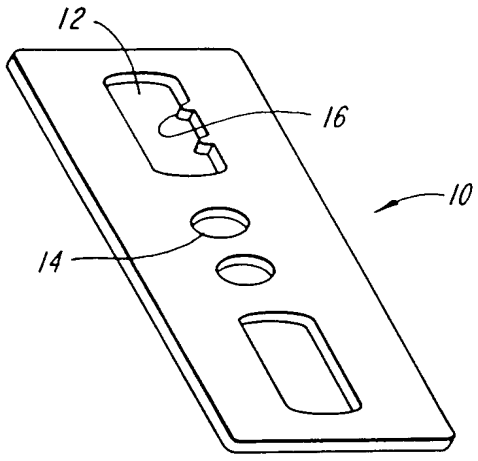

FIG. 1

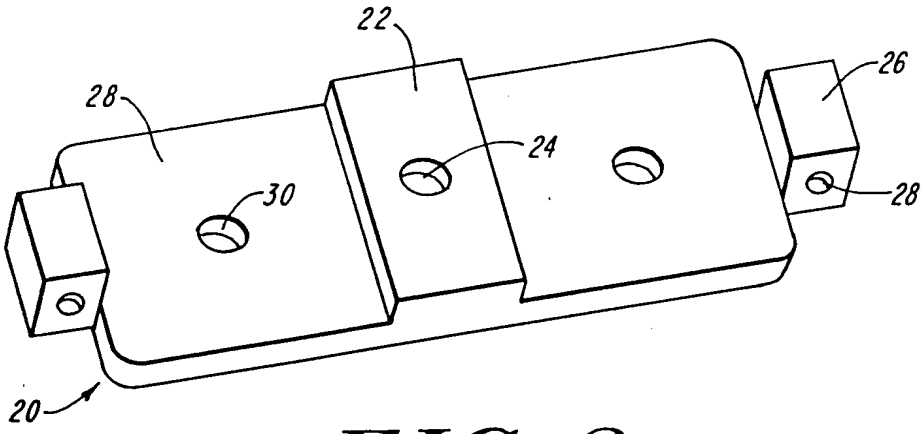

FIG. 2

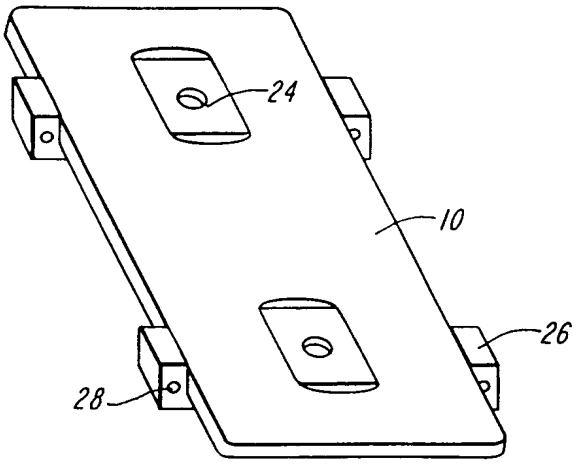

FIG. 3

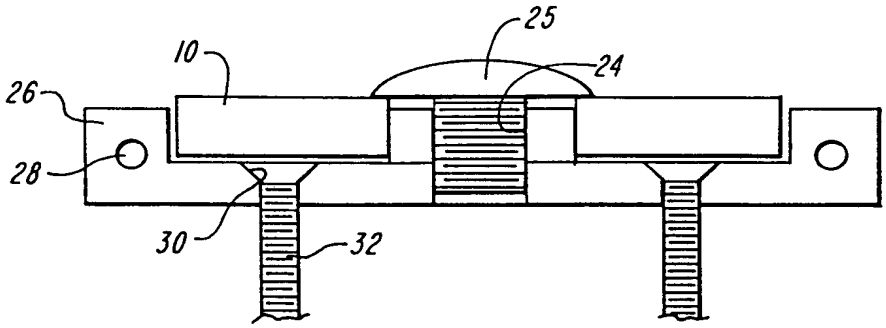

FIG. 4

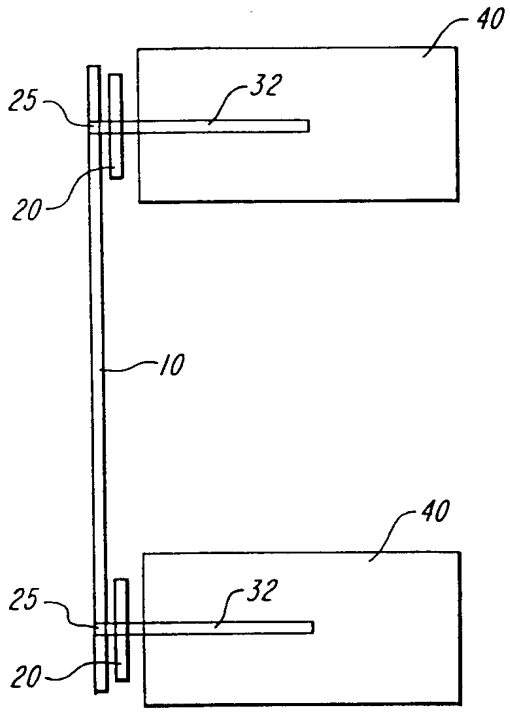

FIG. 5

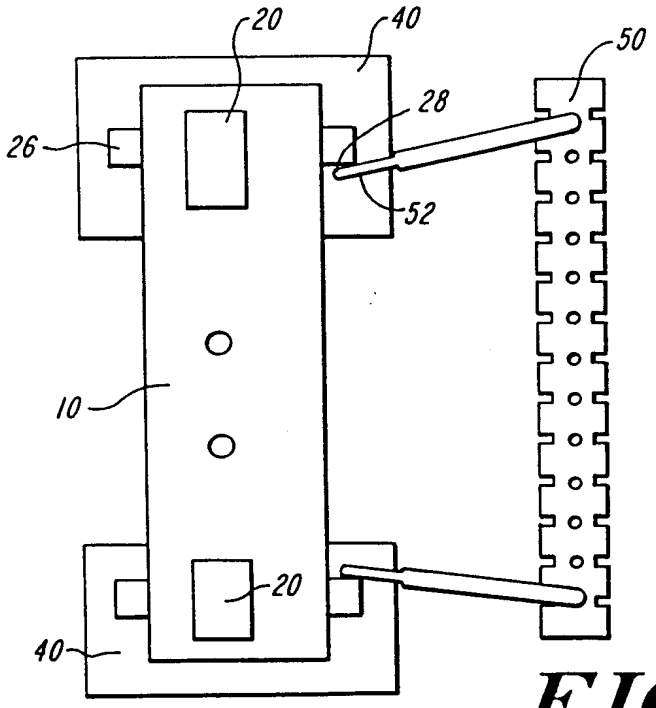

FIG. 6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US00/11247

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) :A61B 17/56, 58; A61F 2/30
US CL :606/69
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 606/63, 64, 69-71, 64, 63, 90, 105

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5,728,127 A (ASHER et al.) 17 March 1998, Figs. 1-4, and col. 2 lines 27-35.	1, 3
X --- Y	US 5,470,333 A (RAY) 28 November 1995, all figures.	1 --- 3
X --- Y	US 5,108,395 A (LAURAIN) 28 April 1992, all figures.	1 --- 2-4
X --- Y	EP 45 5255 A (RAMOTOWSKI) 06 November 1991, Figs. 1 and 2.	1 --- 3

[X] Further documents are listed in the continuation of Box C. [ ] See patent family annex.

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A	US 3,242,922 A (THOMAS) 29 March 1966, entire document.	1-4
A	US 4,657,550 A (DAHER) 14 April 1987, entire document.	1-4
A	US 4,382,438 A (JACOBS) 10 May 1983, entire document.	1-4
A	US 4,714,469 A (KENNA) 22 December 1987, entire document.	1-4